

## RECORDS OF ACULEATE WASPS FROM FLOWERING SUBTROPICAL RAINFOREST TREES

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### Abstract

More than 88 species of aculeate wasps are recorded visiting flowers of 11 species of trees in lowland subtropical rainforest or rainforest - wet sclerophyll forest ecotone sites in northern New South Wales. The tiphiid subfamily Thynninae was the most diverse taxon with 31 species collected.

### Introduction

Adult aculeate wasps feed on nectar (Naumann 1991, Houston 1984) and, in Australia, have been recorded visiting flowers of sclerophyllous plants (Brown 1987, 1989a, b; Armstrong 1979; Houston 1984; Hawkeswood 1981; Allsopp 1992; Webb 1989) and pollinating orchids (Armstrong 1979 and references therein). Apart from a record of the scoliid *Campsomeris tasmaniensis* (Saussure) as a pollinator of *Macadamia* (Proteaceae) (Vithanage and Ironside 1986) and aculeates as pollinators of *Neolitsea dealbata* (Lauraceae), *Litsea lefeana* (Lauraceae) and *Diospyros pentamera* (Ebenaceae) trees in tropical Queensland (House 1985), there are few plant-visiting records for higher wasps in Australian rainforests.

### Methods

Wasps of the families Pompilidae, Scoliidae, Sphecidae, Tiphiidae and Vespidae were collected by hand-netting as they fed on tree blossoms in seven lowland subtropical rainforest sites (*sensu* Adam 1992) and two rainforest-wet sclerophyll ecotone sites in northeast New South Wales (Tables 1, 2). A description of the collection sites, their floristic composition and location is given in Williams (1993) and Williams and Adam (1991). Wasps were observed and collected during three seasons from late 1990 until early 1993. Only wasps that alighted on blossoms were included in the study. Representatives of each species were examined for the presence of pollen.

Twenty species of mass-flowering rainforest trees, possessing unspecialised entomophilous floral morphologies (see Williams and Adam 1994), were included in the study but particular species did not necessarily flower during each season. In addition, the flowering patterns of individual tree species and populations were seasonally heterogeneous so that it was not possible to equally replicate sampling effort. Phenological data on flowering will be published elsewhere.

## Results and Discussion

The number of wasp species attracted to individual tree species is given in Table 1 and flower-visiting records in Table 2. More than 50 percent of the species listed in Table 2 were recorded from only 1 or 2 specimens. Aculeate wasps were not collected from nine of the 20 trees included in the study: *Cassine australis* (Celastraceae) (Manning Point), *Caldcluvia paniculosa* and *Schizomeria ovata* (Cunoniaceae) (Lorien Wildlife Refuge), *Elaeocarpus obovatus* (Lansdowne Reserve) and *E. reticulatus* (Elaeocarpaceae) (Lorien Wildlife Refuge), *Drypetes australasica* (Euphorbiaceae) (Manning Point), *Scolopia braunii* (Flacourtiaceae), *Cyrtocarya microneura* (Lauraceae) and *Acradenia euodiiformis* (Rutaceae) (Lorien Wildlife Refuge).

**Table 1.** Number of wasp species recorded visiting plants. "\*" indicates records from rainforest-wet sclerophyll forest ecotone sites, all other records from rainforest only.

Plant Taxa	Site	No. spp.
<i>Alphitonia excelsa</i>	Harrington	60
<i>Tristaniopsis laurina</i>	Wingham Brush	23
<i>Tristaniopsis laurina</i>	Lorien Wildlife Refuge*	13
<i>Euroschinus falcata</i>	Saltwater Reserve	10
<i>Waterhousea floribunda</i>	Wingham Brush	8
<i>Euroschinus falcata</i>	Harrington	6
<i>Acmena smithii</i>	Harrington	6
<i>Alectryon coriaceus</i>	Manning Point	6
<i>Acmena smithii</i>	Manning Point	5
<i>Cuttsia viburnea</i>	Lorien Wildlife Refuge	4
<i>Acmena smithii</i>	Woko National Park	4
<i>Alphitonia excelsa</i>	Kenwood Wildlife Refuge*	4
<i>Diospyros australis</i>	Lansdowne Reserve	3
<i>Guioa semiglauc</i>	Harrington	3
<i>Waterhousea floribunda</i>	Lorien Wildlife Refuge	2
<i>Diospyros australis</i>	Lorien Wildlife Refuge	1
<i>Abrophyllum ornans</i>	Lorien Wildlife Refuge*	1
<i>Rhodomyrtus psidioides</i>	Lorien Wildlife Refuge*	1
<i>Alectryon coriaceus</i>	Harrington	1

The number of wasp species varied between both plant taxa and collection sites (Tables 1, 2) and the total number of wasps recorded in Table 2 was not present at any single site. Tiphiidae was the most diverse family ( $n = ca$  36 spp.) and *Alphitonia excelsa* (Rhamnaceae) flowers (in rainforest) at

Harrington were visited by the highest number of wasp species ( $n > 60$ ). *A. excelsa* flowers are distinctive in that they produce a fetid odour rather than a sweet fragrance. At other species of flowering trees (and *A. excelsa* trees at Kenwood Wildlife Refuge) there were fewer aculeate wasps and, on these, the anthophilous insect fauna was generally dominated by mixed pollinator guilds principally comprising bees, Diptera, Coleoptera and Thysanoptera. Aculeate wasps occasionally occurred in large numbers on flowering trees (e.g., *Alphitonia excelsa* at Harrington) but did not appear to disturb co-foraging native bees.

All the aculeates examined carried pollen conspecific with that of the flowers from which they were collected; however, individual pollen loads varied and frequently contained pollen of more than one species, indicating that individual wasps may not exhibit foraging fidelity. Data in Table 2 also indicate a general lack of fidelity. Large wasps may undertake relatively long-distance interplant flights exceeding 200 m (G. Williams, pers. obs.) and potentially contribute to out-crossing in subtropical rainforest tree populations, which typically consist of widely scattered individuals.

Few studies have addressed the contribution of anthophilous wasps to the breeding systems of rainforest plants. However, several ecological studies provide data on wasps as flower visitors in non-rainforest plant communities. Petanidou and Ellis (1993), in a 30 ha Greek 'phrygana' shrubland plot, collected 21 species of Sphecidae and 15 species of Vespidae. Heithaus (1979) collected Pompilidae (12 spp.), Scoliidae (3 spp.), Sphecidae (39 spp.), Tiphidae (10 spp.) and Vespidae (52 spp.) from Costa Rican savannah and tropical deciduous and oak forests [these are similar to 'dry rainforest' under Australian closed forest classifications and were regarded as rainforest by Schimper (1903)], but >50 percent of species were represented by only 1 or 2 individuals. Inoue *et al.* (1990) recorded Scoliidae (1 sp.), Sphecidae (16 spp.) and Vespidae (11 spp.) from a Japanese temperate deciduous forest and Kato *et al.* (1990) recorded Sphecidae (10 spp.) and Vespidae (5 spp.) from Japanese primary beech forest (presumably in these forests the pollinators are understorey specialists as the canopies are wind pollinated). Vespidae (5 spp.) and Sphecidae (2 spp.) were collected by Kato *et al.* (1993) from flowers in Japanese cool-temperate subalpine forests and meadows.

In comparison with the records of Heithaus (1979), Inoue *et al.* (1990) and Kato *et al.* (1990, 1993), Tiphidae were well represented in our study region and comprised approximately 41 percent of the wasp diversity (species richness:  $n = > 88$  spp.). However, this at least in part may be due to the greater representation of tiphids in Australia; Tiphidae constituted <8% of wasp taxa recorded by Heithaus (1979) from neotropical habitats. Most of the tiphids collected by us were Thynninae, which is a diverse and abundant subfamily in Australia and occurs widely on Australian sclerophyllous plants (Hawkeswood 1981; Brown 1987, 1989a, b; Armstrong 1979; Keighery

1975). However, Inouye and Pyke (1988) did not record thynnines visiting the 43 species of alpine flora they observed in Kosciusko National Park, southern New South Wales. In Australian lowland subtropical rainforest and adjoining ecotonal forests, Thynninae may be a significant component of the anthophilous wasp community, which in palaeartic, nearctic and neotropical forests is dominated by Sphecidae and Vespidae.

**Table 2.** Aculeate wasps collected from flowers of rainforest trees.  
(number in parentheses = number of species).

### Plant Species

- 1 - *Euroschinus falcata* (Anacardiaceae). 2 - *Diospyros australis* (Ebenaceae).  
3 - *Abrophyllum ornans* (Escalloniaceae). 4 - *Cuttsia viburnea* (Escalloniaceae).  
5 - *Acmena smithii* (Myrtaceae). 6 - *Rhodomyrtus psidioides* (Myrtaceae).  
7 - *Tristaniopsis laurina* (Myrtaceae). 8 - *Waterhousea floribunda* (Myrtaceae).  
9 - *Alphitonia excelsa* (Rhamnaceae). 10 - *Alectryon coriaceus* (Sapindaceae).  
11 - *Guioa semiglaucula* (Sapindaceae).

### Sites

- A - Harrington (32°52'30"S, 152°41'00"E).  
B - Manning Point (31°53'30"S, 152°40'00"E).  
C - Saltwater Reserve (approx. 12 km SE of Taree) (32°00'30"S, 152°33'45"E).  
D - Lansdowne Reserve (0.5 km SE Lansdowne) (31°47'30"S, 152°32'30"E).  
E - Lorien Wildlife Refuge (3 km N Lansdowne: 2 sites) (31°45'00"S, 152°32'30"E).  
F - Kenwood Wildlife Refuge (4 km NNW Lansdowne) (31°44'45"S, 152°31'30"E).  
G - Wingham Brush (Wingham) (31°52'40"S, 152°22'00"E).  
H - Woko National Park (approx. 24 km NNW Gloucester) (31°49'00"S, 151°47'00"E).

### Month of Collection

N (Nov.), D (Dec.), J (Jan.), F (Feb.), M (Mar.).

Species	Plant/Site	Month
<b>POMPILIDAE</b>		
<i>Chirodamus defensor</i> Smith	8G	D
<i>Chirodamus ?raptor</i> Smith	7E	D
<i>Chirodamus</i> sp./spp.	7G(3), 8E, 9A(2)	NDJ
? <i>Chirodamus</i> sp./spp.	1C	N
<i>Chryptocheilus bicolor</i> (Fabricius)	7G	J
<i>Chryptocheilus</i> sp./spp.	9A(2)	JF
? <i>Chryptocheilus</i> sp./spp.	8G, 9A	DJ
<i>Phanagenia fasciata</i> Fabricius	1C	N
<i>Platyderes collaris</i> (Fabricius)	9A	F

**Table 2 (cont.).** Aculeate wasps collected from flowers of rainforest trees.

Species	Plant/Site	Month
<b>SCOLIIDAE</b>		
<i>Campsomeris ?tasmaniensis</i> (Saussure)	2E, 9A	DF
<i>Campsomeris zonata</i> Smith	7E	D
<i>Scolia verticollis</i> (Fabricius)	7E, 9A	DJF
<i>Scolia ?verticollis</i> (Fabricius)	7G	J
<i>Scolia</i> sp. nr. <i>verticollis</i> (Fabricius)	7G	J
<i>Scolia</i> sp./spp.	1C, 7G, 9A(3)	DJF
? <i>Scolia</i> sp./spp.	1C	D
<b>SPHECIDAE</b>		
<i>Acanthostethus</i> sp./spp.	1A, 9A(2)	NJF
<i>Bembicinus</i> sp.	1A, 9A	NF
<i>Bembix ?kamulla</i> Evans and Matthews	7E	D
<i>Bembix promontorii</i> Lohrman	9A	J
<i>Bembix</i> sp./spp.	5B, 9A(2), 10B(2)	NDJF
<i>Cerceris ?australis</i> Saussure	7G	D
<i>Cerceris minuscula</i> Turner	7G	DJ
<i>Cerceris</i> sp./spp.	5H, 7E, 7G	DJ
<i>Ectemnius reginellus</i> Leclercq	9A	F
? <i>Ectemnius</i> sp.	8G(2), 9A	NDF
<i>Larra</i> sp.	9A	F
<i>Pison</i> sp.	9A	F
<i>Sceliphron laetum</i> (Smith)	7G, 9A	DF
<i>Sericophorus</i> sp.	9A	J
<i>Sphex ephippium</i> Smith	9A	F
<i>Sphex fumipennis</i> Smith	9A	F
<i>Sphex globosus</i> Smith	9F	F
<i>Sphex ?luctuosus</i> Smith	7E	D
<i>Sphodrotes</i> sp./spp.	1A, 9A(2), 9F	NJFM
? <i>Sphodrotes</i> sp./spp.	9A	F
<i>Spilomena</i> sp./spp.	4E(2), 8E	ND
<i>Tachysphex</i> sp.	1A, 1C, 9A(2), 9F	NDJF
? <i>Tachysphex</i> sp./spp.	9A(2), 10B(2)	DJFM
<i>Williamsita</i> sp./spp.	9A	J
<b>TIPHIIDAE</b>		
<b>Anthoboscinae</b>		
<i>Anthobosca australasiae</i> Guerin	8G	D
<i>Anthobosca ?laevifrons</i> (Smith)	1C	D
<i>Anthobosca signata</i> Smith	7E, 9A	DJF
<i>Anthobosca ?signata</i> Smith	7E	J
<b>Diamminae</b>		
<i>Diamma bicolor</i> Westwood	9A	J
<b>Thynninae</b>		
<i>Acanthothynnus ater</i> Brown	9A	F
<i>Acanthothynnus ?ater</i> Brown	9A	F
<i>Agriomyia maculata</i> Guerin	7G	J
<i>Agriomyia manifesta</i> Turner	5H	N

Table 2 (cont.). Aculeate wasps collected from flowers of rainforest trees.

Species	Plant/Site	Month
<b>TIPHIIDAE (cont.)</b>		
<b>Thynninae (cont.)</b>		
<i>Agriomyia variegata</i> Klug	8G	D
<i>Dimorphothynnus dimidiatus</i> (Smith)	5A, 5B, 9A, 11A	NF
<i>Epactiothynnus tasmaniensis</i> (Saussure)	9A	FM
<i>Epactiothynnus ?tasmaniensis</i> (Saussure)	5A	N
? <i>Epactiothynnus</i> sp.	9A	F
<i>Eirone ?parca</i> (Turner)	7G	J
<i>Eirone</i> sp. nr. <i>parca</i> (Turner)	5H, 7E, 7G, 8G	NDJ
<i>Eirone schizorhina</i>	7G	D
<i>Eirone</i> sp. nov.	7g	J
<i>Hemithynnus apterus</i> (Oliver)	5B	N
<i>Hemithynnus rufiventris</i> (Guerin)	7E	F
<i>Lesticothynnus fravenfeldianus</i> (Saussure)	7E	D
<i>Rhagigaster ?denticulatus</i> (Turner)	9F	F
<i>Rhagigaster</i> sp. nr. <i>kiandrensis</i> Guerin	5A, 9A, 11A	NDJF
<i>Rhagigaster ?mutatus</i> Turner	9A	F
<i>Rhagigaster ?unicolor</i> Guerin	7G, 8G	D
<i>Thynnoturneria sanguinolentus</i> (Turner)	7G	DJ
<i>Thynnoturneria</i> sp. nr. <i>umbripennis</i> (Smith)	7G, 9A	DJF
? <i>Thynnoturneria</i> sp.	9A	J
<i>Tmesothynnus dispersus</i> (Turner)	1C, 9A	NF
<i>Tmesothynnus iridipennis</i> (Smith)	7G	D
<i>Zaspilothynnus</i> sp. nr. <i>campanularis</i> (Smith)	9A	F
<i>Zeleboria contigua</i> (Turner)	5A	N
<i>Zeleboria ?contigua</i> (Turner)	5B, 9A, 11A	NDF
<i>Zeleboria</i> sp. nr. <i>contigua</i> (Turner)	1C	N
<i>Zeleboria xanthorrhoei</i> (Smith)	5A, 5B, 9A	NF
? <i>Zeleboria</i> sp.	9A	JF
<b>VESPIDAE</b>		
<b>Polistinae</b>		
<i>Polistes humilis</i> (Fabricius)	1C, 6E, 9A, 10B	N - M
<i>Polistes ?humilis</i> (Fabricius)	4E, 9A	DF
<i>Polistes tepidus</i> (Fabricius)	9A	F
<i>Ropalidia</i> sp./spp.	4E	D
<b>Eumeninae</b>		
<i>Abispa splendida</i> (Guerin)	7E, 9A	DM
<i>Abispa ?splendida</i> (Guerin)	7G	J
<i>Bidentodynerus bicolor</i> (Saussure)	7G	D
<i>Deuterodiscoelius ephippium</i> Saussure	2D	D
? <i>Epidodynerus</i> sp./spp.	2D(2), 7E, 9A	DJ
<i>Leptomenoides</i> sp./spp.	9A	J
<i>Paralastor</i> sp./spp.	1A(3), 1C, 3E, 5A, 5H, 9A(3), 10A, 10B,	NDJF
<i>Pseudabispa confusa</i> van der Vecht	7G, 9A	J

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